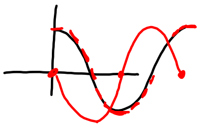
3.5 Derivatives of trig functions

If x is measured in radians then what is dy/dx?



y=sin(x)	$y' = \cos x$
y=cos(x)	$y' = -\sin x$
y=tan(x)	$y' = \sec^2 x$
y=sec(x)	$y' = \sec x \tan x$
y=csc(x)	$y' = -\csc x \cot x$
y=cot(x)	$y' = -\csc^2 x$

$$\frac{d}{dx}\frac{\sin x}{\cos x} = \frac{\cos x \cos x - \sin x(-\sin x)}{\cos^2 x} = \frac{\cos^2 x + \sin^2 x}{\cos^2 x} = \frac{1}{\cos^2 x} = \sec^2 x$$

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Find the derivatives of (a) y=x^2*sin(x) and (b) y=cos(x)/(1-sin(x))

a) $\frac{d}{dx} x^2 \sin x = x^2 \cos x + 2x \sin x$

b) $\frac{d}{dx}\left(\frac{\cos x}{1-\sin x}\right) = \frac{(1-\sin x)(-\sin x) - \cos x(-\cos x)}{(1-\sin x)^2}$

$$= \frac{-\sin x + \sin^2 x + \cos^2 x}{(1-\sin x)^2}$$

$$= \frac{-\sin x + 1}{(1-\sin x)^2} = \frac{1-\sin x}{(1-\sin x)^2}$$

$$= \frac{1}{1-\sin x}$$

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If y=sec(x) find y''

$y' = \sec x \tan x$

$y'' = \sec x \cdot \sec^2 x + \tan x \cdot \sec x \tan x$

$= \sec^3 x + \tan^2 x \sec x$

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Find the equations of the lines that are tangent and normal to the graph of y=tan(x)/x at x=2. Take derivatives by hand but use your calculator to plug in x=2.

$y = \frac{\tan x}{x}$ $\quad y' = \frac{x\sec^2 x - \tan x}{x^2}\Big|_{x=2}$

$y(2) = -1.09$ $\quad y'(2) = 3.43$

tan line $\quad y = 3.43(x-2) - 1.09$

normal $\quad y = -\frac{1}{3.43}(x-2) - 1.09$

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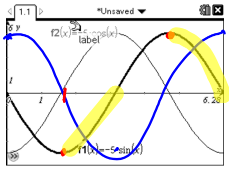
Simple Harmonic Motion

position: s=5cos(t)

velocity: $v = \frac{ds}{dt} = -5\sin t$

acceleration: $a = -5\cos t$

jerk: $= \frac{d}{dt} a = 5\sin t$



velocity and acceleration

When is the particle moving fastest? $t = \frac{\pi}{2}, \frac{3\pi}{2}$

When is the particle slowing down? $\left(\frac{\pi}{2}, \pi\right) \cup \left(\frac{3\pi}{2}, 2\pi\right)$

when v & a have opposite signs

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